Noise is unwanted sound. In a world of constant natural and manmade sounds, those that are perceived as noise vary among people in the community. The pivotal issue is the impact or annoyance. To some, loud military sound is "the sound of freedom." Conversely, others feel military noise deprives them of privacy and quiet. They are startled by unexpected noise that interferes with normal activities, such as sleep or conversation. The military's environmental noise management efforts are intended to minimize such annoyance.

How does the Department of Defense assess noise and its impacts?

How does the Department of Defense quantify noise and predict annoyance?

While it is difficult to directly measure annoyance, studies have found that sound levels can help to predict how people will react to different noises. Several different measurement tools and instruments are used during military noise assessments and mapping. Each is appropriate for measuring a certain type of noise and accounting for how a particular noise is received by people.

Day-Night Sound level (DNL)

The DoD uses a widely accepted metric (evaluator) to measure environmental noise. The day-night sound level (DNL) evaluator is recommended by the Environmental Protection Agency and used by most federal agencies as a land-use planning tool. It describes the average daily acoustic energy over the period of one year—meaning that moments of quiet are averaged together with moments where loud noises can be heard. The DoD uses DNL because it incorporates a "penalty" for nighttime noise (normally 10:00 p.m. to 7:00 a.m.) when loud sounds are more annoying.

Weighted Noise Levels

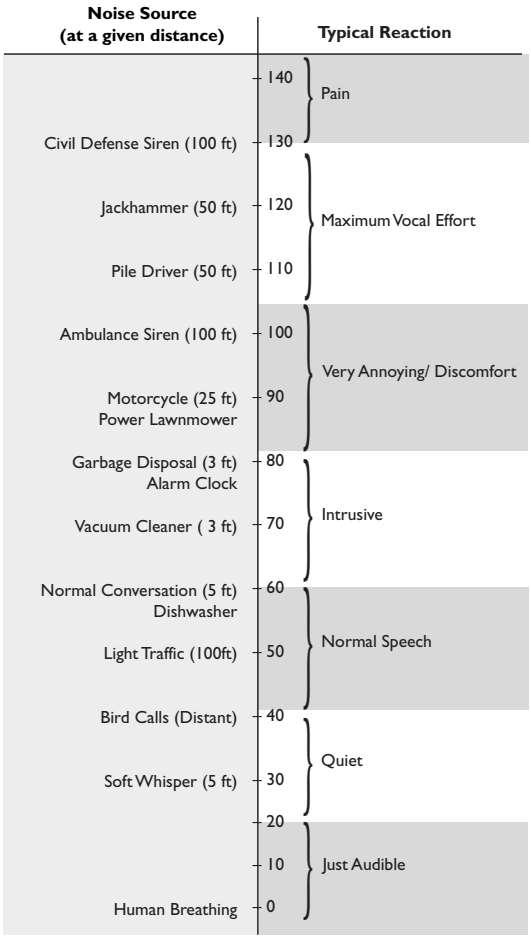
When measuring noise levels from aircraft, vehicles, generators, trains, and small arms, acoustical experts screen out very high and low sound frequencies that are beyond the range of human hearing. DNL measurements are "weighted" to reflect what people actually hear (A-weighting). Similarly, intense low-frequency noise that can cause vibration in nearby homes is weighted to reflect what people actually feel (C-weighting). Most people find lower-frequency sounds (e.g., explosions, artillery, sonic booms) more annoying than other noises. Vibration, like annoyance, is difficult to measure. So C-weighted noise levels are used to predict vibration and account for the additional annoyance.

Individual responses of community members to noise depends on many noise factors:

- intensity,
- duration,
- repetition,
- abruptness of onset or cessation,
- background or ambient noise levels,
- interference with activity,
- previous experiences within the community,
- time of day,
- fear of personal danger from the noise sources,
- socioeconomic status and education level of the community, and
- the extent people believe that the noise could be controlled.

Insert installation name here

Common Sounds and Noise Levels (A-weighted)



Peak or Maximum Noise Levels

Occasionally, the DoD uses "unweighted" peak sound levels or maximum sound levels to assess maximum noise levels during single-noise events. This is necessary when the DNL (average) noise measurements might understate the severity of a single-noise event. Sometimes annoying noise peaks can be "averaged out." For example, the average noise level is irrelevant to a mother upset about a child awakened from naps by aircraft operations or infrequent tank firing. Unweighted peak measurements, with no time averaging, are a good predictor of complaints.

Noise levels are measured in terms of a quantity known as "decibels," abbreviated as dB. Normal speech has a noise level of approximately 60 dBA (A-weighted), and a busy street corner has a noise level of approximately 80 dBA. Since decibels are numbers on a logarithmic scale, they cannot be added using standard arithmetic.

What is the DoD doing to reduce annoyance?

The DoD Community and Environmental Noise Management Program was specifically designed to help base/installations work with their civilian neighbors to control the impacts of environmental noise. It can guide noise management efforts both on and off a base/installation. Noise management programs include the following elements:

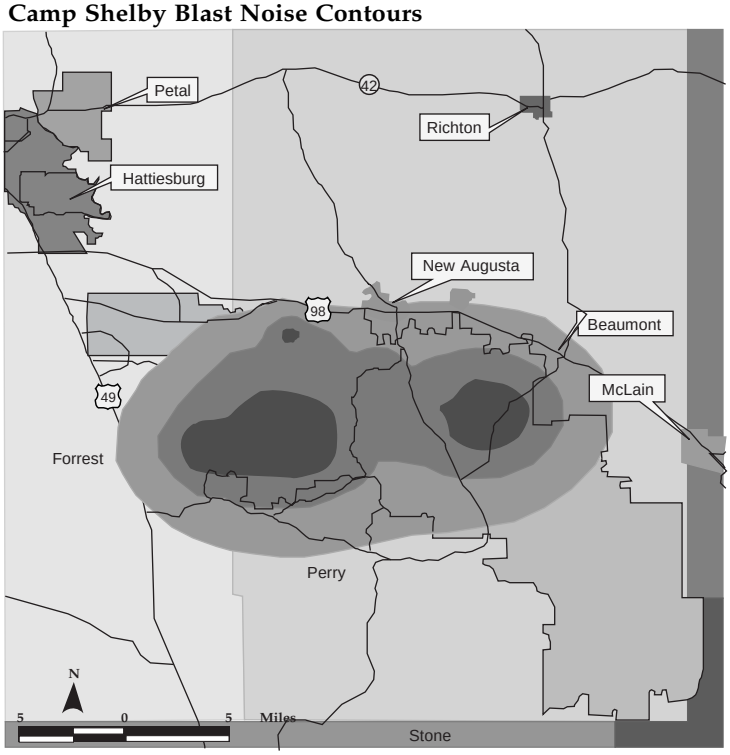
- noise assessment,
- noise education,
- complaint management,
- noise mitigation, and
- vibration information.

Noise assessment, essential for developing any noise management program, is done through environmental noise management plans, which is a base/installation-specific study of the existing and future noise environment. Noise contour maps, the technical heart of the plan, show where the noise environment is incompatible with noise-sensitive land uses. These areas are depicted as "Noise Zones."

Single-Event Noise

The energy average noise contours do not provide an accurate depiction of maximum noise levels from loud, single-noise events. So when planning certain noisy activities, the DoD compares the expected noise level to standard guidelines. Weather and other factors that influence how sound travels are also analyzed. (See fact sheet titled "How is noise mitigated?") Information in the following tables can be compared with expected noise levels to determine whether there is a risk for adverse impacts on the community.

Camp Shelby Blast Noise Contours



Noise Zones

LUPZ ZNII ZNIII

Noise Zones Land Use Planning	Percent Population Highly Annoyed	A-weighted dB (ADNL) limit	C-weighted dB (CDNL) limit
Zone (LUPZ)	9 – 15	60 – 65	57 – 62
Zone I	<15	<65	<62
Zone II	15 – 39	65 – 75	62 – 70
Zone III	>39	>75	>70

Land Use Planning Zone (LUPZ)

To better account for the annoyance from installation training noise, the Army developed and uses the LUPZ. An LUPZ is essentially a buffer beyond Noise Zone II that encompasses areas where, during periods of increased operations, community annoyance levels can reach those levels associated with Zone II. The use of LUPZ contours provides the local community additional information to make better-informed land-use decisions.

Land use compatibility with noise zones

Land Use	Noise Zone I	Noise Zone II	Noise Zone III
Outdoor amphitheaters (incompatible over 60 ADNL)	❍	●	●
Nature and wildlife preserves, livestock farming, neighborhood parks and playgrounds	❍	▲	●
Schools, preschools, libraries	❍	▲	●
Residential: Single-family, multiple-family, and mobile homes; residential hotels; retirement homes; intermediate care facilities; hospitals; and nursing homes	❍	●	●
Hotels and motels, other transient lodging, auditoriums, concert halls, indoor arenas, churches	❍	▲	▲
Office buildings; business, education, professional and personal services; R&D offices and laboratories	❍	▲	●
Water recreation facilities, riding stables, regional parks and athletic fields, cemeteries, outdoor spectator sports, golf courses	❍	▲	●
Commercial/retail, shopping centers, restaurants, movie theaters	❍	▲	▲
Commercial/wholesale, industrial, manufacturing (industries with vibration-sensitive equipment may be incompatible)	❍	▲	▲
Agricultural (except residences and livestock), extract industry, fishing, utilities, and public rights-of-way	❍	❍	❍

Note: Noise contours and Accident Potential Zones are subject to change. They will be periodically updated in association with mission changes at the installation.

❍ Compatible
▲ Conditionally incompatible
● Incompatible

Aircraft Noise

Studies have found that a good predictor of annoyance at airfields with 50–200 operations per day is the maximum level of the three noisiest events.*

Percentage of population highly annoyed from aircraft noise (Rylander 1974)

Maximum level (dBA)	Percentage highly annoyed
70	5
75	13
80	20
85	28
90	35
95	43

Small Arms Noise

A Swedish study of annoyance caused by noise from shooting ranges showed the annoyance for this type of noise is low up to a certain threshold—approximately 63 dB—after which it increases relatively quickly.**

Percentage of population highly annoyed from small arms range noise (Sorensen and Magnusson 1979)

Decibels (dBA)	Percent highly annoyed
<63	2
63	10
65	13
70	21
75	29
80	38

Blast Noise

A set of guidelines developed by the Naval Surface Warfare Center, Dahlgren, Virginia, is used to evaluate the complaint potential from low-frequency sound (impulsive noise) that is caused by activities such as detonating explosives and artillery firing.***

Blast noise guidelines (Pater 1976)

Predicted sound level in decibels	Risk of complaints and damage
<115	Low risk of noise complaints
115 – 130	Moderate risk of noise complaints
130 – 140	High risk of noise complaints, possibility of damage
>140	Threshold for permanent physiological damage to unprotected human ears. High risk of physiological and structural damage claims.

*Rylander, et al., 1974, "Re-Analysis of Aircraft Noise Annoyance Data Against the dBA Peak Concept," infrequent, Vol. 36, 399–406.

**Sorenson and Magnusson, 1979, "Annoyance Caused by Noise from Shooting Ranges," infrequent, Vol. 62, 437–442.

***Pater, 1976, "Noise Abatement Program for Explosive Operations at NSWC/DL," presented at the 17th Explosives Safety Seminar of the DoD Explosives Safety Board.

*For more information about the **Army's noise management program**, contact:*
Operational Noise Program
U.S. Army Center for Health Promotion and Preventive Medicine
MCHB-TS-EON
Aberdeen Proving Ground, MD 21010-5403
410-436-3829
http://chppm-www.apgea.army.mil/dehe/morenoise/

*For more information on the **Navy's noise management program**, contact:*
Special Assistant for AICUZ and Encroachment
Commander Navy Installations
Naval Facilities Engineering Command
Washington Navy Yard, Washington DC 20374
202-685-9181

*For more information on the **Air Force's noise management program**, contact:*
AICUZ/Noise Program Manager
Bases and Units Branch
HQ USAF/ILEPB
1260 Air Force Pentagon
Washington, D.C. 20330.
703-604-5277

*For more information on the **Marine Corp's noise management program**, contact:*
Community and Land Use Planner
Headquarter Marine Corps
Washington DC, 20380-1775
703-695-8240, ext 3350

This fact sheet is part of *Tri-Services Community and Environmental Noise Primer.* This guide, along with its companion CD, can help you educate and engage stakeholders on and off your installation, and generate support for noise management activities.

Insert local contact information here